CALIFORNIA DIVISION OF MINES AND GEOLOGY

Supplement #1 to Fault Evaluation Report FER-45

April 10, 1978

1. Name of fault:

Northeast-trending faults in the Redlands-Yucaipa Valley area.

4. References (aerial photography):

Designation: Fairchild C-2400

Type: black and white

Scale: 1:4,800

Date flown: 1932

Area of coverage: Mill Creek Wash, to the northwest of the Crafton Hills.

Availability: Fairchild aerial photography collection, Geology Department, Whittier College, Whittier, California.

Designation: Fairchild C-10835

Type: black and white

Scale: 1:14,000

Date flown: 9-4-46

Area of coverage: One flight line extending westward from the western part of Yucaipa Valley. Includes the southwesternmost end of the Western Heights fault zone and the southern two-thirds of both the Crafton and Redlands faults.

Availability: Fairchild aerial photography collection, Geology Department, Whittier College, Whittier, California.

Designation: GSVR

Type: black and white

Scale: 1:24,000

Date flown: 7-11-52, 7-13-52, and 7-14-52.

Area of coverage: The Yucaipa Valley area.

Availability: San Francisco District aerial photography file, California Division of Mines and Geology, Ferry Building, San Francisco.

Designation: WRD-5D6

Type: black and white

Scale: 1:15,000

Date flown: 6-17-66

Area of coverage: A strip about 6 km wide along the San Andreas fault zone. Includes the northeasternmost 2 km of the Western Heights fault.

Availability: Los Angeles District aerial photography file, California Division of Mines and Geology, Los Angeles.

6 & 7. Interpretation of aerial photography and field observations:

A study of aerial photo sets Fairchild C-2400 (1932) and Fairchild C-10835 (1946) showed *no* evidence of Holocene faulting along the Redlands and Crafton faults (figures 3a and 3b of FER-45). The southwestern parts of both of these faults are characterized by fault-line scarps. These scarps have been significantly modified by erosion, and local drainages crossing the scarp have long since entrenched themselves to the level of the downthrown surface. There is no indication of recent rejuvenation of these drainages or any other indication of recent reactivation of movement.

The northeastern parts of the Crafton and Redlands faults are shown as subsurface water barriers by Burnham (1960), and Dutcher and Burnham (1959 and 1960). I observed no surface evidence of faulting on the aerial photos covering those areas.

The aerial photo study indicated that field checking of the Redlands and Crafton faults is not warranted; no field examination of these faults has been conducted.

A study of aerial photo sets GSVR (1952) and WRD-5D6 (1966) showed abundant surface evidence of faulting along the Western Heights fault zone and the Chicken Hill fault zone (figure 4 of this supplement). (Note: The use of the names "Western Heights fault" and "Chicken Hill fault" is somewhat different on figure 4 of this supplement than on figure 3a of the original FER-45. In discussions in February, 1978, with Gary S. Rasmussen, we decided that a change in nomenclature was necessary. The fault geometry and gross structural character of the area indicate that the faults along the southeastern side of the Crafton Hills are part of one continuous fault zone, herein called the Western Heights fault zone. This zone is separated by a graben -- the northeast-trending valley along which Oak Glen Creek flows -- from the fault zone along the northwestern side of Chicken Hill. We retain the name "Chicken Hill fault" for the fault zone to the southeast of Oak Glen Creek. Dutcher and Burnham (1960) extend the Chicken Hill fault northward across Oak Glen Creek, to join with the fault zone along the southeastern side of the Crafton Hills. This construction is based on weak evidence in the form of widely scattered water well logs. Furthermore, much of their "crossover" fault is shown as a solid line, indicating surface faulting.

However, I was unable to find any evidence of surface faulting there, either on the ground or on aerial photos.)

The Western Heights and Chicken Hill faults are manifested by fault scarps, fault-line scarps, and, in some places, photo-tone contrasts. The photo study indicated that field checking was definitely warranted, and approximately one week was subsequently spent in the field detailing these faults. Figure 4 of this supplement shows all of the surface faulting that I was able to find evidence for in the Yucaipa Valley area. I checked all surface fault traces as mapped by previous workers (compiled on figure 3a of FER-45). A comparison of figure 4 to figure 3a will show a number of places where I was unable to find any indication of previously mapped fault traces.

The faults shown on figure 4 are annotated to indicate my interpretations as to the ages of the units cut (or not cut) by the faults, and the geomorphic youthfulness of the scarps. I was able to find numerous exposures of the fault planes, and many of these places of exposure are indicated by the fault-plane attitude symbols shown on figure 4.

The Western Heights fault zone was observed to consist of a series of southeast-dipping normal faults. The normal-fault character is evidenced by the fault scarps that consistently show the southeastern side downthrown, and by the lithologic juxtaposition which, where recognizable, always shows the older rock on the northwestern side of the fault.

The southwestern third of the fault zone is characterized by scarps in alluvium. The faulted alluvium is generally of late Pleistocene age, but locally, along the southernmost trace of the southwesternmost one kilometer of the fault zone, the alluvium is probably of Holocene age. The southernmost scarp is the one that was trenched by Rasmussen (1977a of FER-45). On the basis of the trench exposures, he interprets this fault trace to have been active during Holocene time. This scarp, about 3 m to 4 m high, has a very youthful geomorphic appearance, and is only slightly dissected by the drainages that flow across it.

The middle and northeastern thirds of the Western Heights fault zone are mainly characterized by older alluvium downfaulted against crystalline basement rock, but locally these faults show basement rock against basement rock. The fault scarps along this part of the fault zone are highly modified. At the extreme northeastern end of the fault zone I was unable to find any scarps or exposures of the fault. Older alluvium constitutes the lithology at the surface in that area. The queried faults shown on figure 4 are based on some gross topographic trends and photo-tone changes observed on the aerial photography (GSVR, 1953, frames 7-51 and 7-52).

I also mapped an unnamed fault scarp that extends eastward from the northeastern end of the Western Heights fault zone. This scarp ranges from 5 m to 12 m in height. I could not find exposures of the fault -- only the eroded scarp. I found no evidence for faulting as recent as Holocene time along that scarp.

The Chicken Hill fault zone consists mainly of a series of northeast-trending, northwest-dipping normal faults. At the north-

eastern end of the zone, however, there are several short northwest-trending, southwest-facing scarps. The southwestern two-thirds of the fault zone is characterized by well-eroded modified scarps. The faults are exposed in at least three places at road cut excavations -- indicated by the three fault-plane dip symbols shown on figure 4. There is no indication of Holocene movement along this part of the fault zone. To the north of the eastern extension of West Avenue, most of the faulting is manifested by very youthful-appearing scarps. An exception to this is the easternmost fault, shown as a dashed fault. This fault is manifested by a well-eroded modified scarp similar to the faults farther to the southwest. The youthful-appearing scarps are 2 m to 3 m high. Rasmussen (1977b) made 5 trench excavations in this area. These trenches cross two of the scarps that I have mapped. Figure 5 shows the locations of Rasmussen's trenches and my mapped scarps (in blue). The red lines show the location of the faults that were observed in the trenches. His trenches confirm the existence of faults associated with at least one, and possibly two of the scarps that I have mapped. The genesis of the other scarps remains conjectural. There is some question as to whether they are man-made excavation features rather than fault scarps. However, the GSVR (1952) aerial photography clearly shows these scarps. Furthermore, they were largely covered by mature orchards at that time. This indicates that if the scarps were man-made, the excavations had to have been made no later than the 1930's. There is no indication as to why such excavations would have been made at that early date in this area. The geometry of the scarps is such that they were obviously not made to provide irrigation terracing or drainage control for the orchards. Likewise, the geometry indicates that the scarps are not erosional features.

8. Conclusions

Along the Western Heights fault zone, only the southernmost trace at the southwestern end of the zone exhibits strong evidence for Holocene activity. Along the rest of the fault zone, the evidence for recency is inconclusive. Most of the traces along the northeastern two-thirds of the fault zone cross terrane that has been undergoing active erosion since before Holocene time. Thus, there are no Holocene units overlying the fault traces other than local colluvium or very recent alluvium deposits along the drainages that cross the fault zone. Along the Chicken Hill fault zone, only the youthful-appearing scarps at, and northeast of, the eastern extension of West Avenue exhibit strong evidence for Holocene activity. Farther to the southwest, the fault traces extend through terrane that is actively eroding. Again, the evidence for or against Holocene activity is inconclusive.

Generally, the faults shown on Figure 4 are at least fairly well defined, and in many places are very well defined.

9. Recommendations

I recommend that most of the Western Heights and Chicken Hill fault zones, as shown on Figure 4, be zoned. Figure 6 shows the fault traces and segments that I recommend to be zoned. The existing zone at the northeastern end of the Western Heights fault should be modified.

10. Investigating geologist's name and date:

Drew P. Smith

DREW P. SMITH
Assistant Aphid
April 10, 1978

I agree with recommendation to zone faults shown on fig. 6.
EHH
5/10/78